

CLAIMS

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1. A method for forming at least partially solid material, which comprises subjecting liquid at an outlet to an electric field thereby causing the liquid to form at least one jet of electrically charged liquid, the liquid being such that after formation the at least one jet forms a fibre or breaks up into fibre fragments or particles.

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2. A method of forming a coating or covering on a surface, which comprises subjecting liquid at an outlet to an electric field in the vicinity of the surface thereby causing the liquid to form at least one jet of electrically charged liquid, the liquid being such that after formation the at least one jet forms a charged fibre which is attracted to said surface and deposits onto said surface or breaks up into charged fibre fragments or charged particles which are attracted to and deposit onto said surface.

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3. A method of forming a dressing for an area of an animal such as a wound, a burn or an area exposed by a surgical procedure, which comprises subjecting liquid to an electric field at an outlet in the vicinity of the area to be dressed thereby causing the liquid to form at least one jet of electrically charged liquid, the liquid being such that after formation the at least one jet forms a charged fibre which is attracted to said area and deposits onto said area, or breaks up into charged fibre fragments which are attracted to and deposit onto said area, so as to form a mat or web on said area to be dressed.

4. A method of forming a dressing for a wound, a burn or an area exposed by a surgical procedure, which comprises subjecting liquid to an electric field at an

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outlet adjacent a substrate to be applied to the wound, burn or area exposed by a surgical procedure, thereby causing the liquid to form at least one jet of electrically charged liquid, the liquid being such that after formation the at least one jet forms a charged fibre which is attracted to said substrate and deposits onto said substrate or breaks up into charged fibre fragments or particles which are attracted to and deposit onto said substrate so as to form a layer on said substrate.

5. A method of depositing material into a cavity or onto a concave surface, which comprises subjecting liquid to an electric field, thereby causing the liquid to form at least one jet of electrically charged liquid, the liquid being such that after formation the at least one jet forms charged matter comprising a charged fibre, charged fibre fragments or charged particles and at least partially electrically discharging the charged matter prior to supply to the cavity or onto the concave surface.

25 6. A method according to claim 5, which further comprises supplying the at least partially electrically discharged matter to the said cavity or concave surface from a location remote from said cavity or concave surface.

30 7. A method according to any one of claims 2 to 6, which comprises repeating or continuing the deposition process to deposit a number of layers one on top of the other.

35 8. A method according to any one of claims 2 to 7, which further comprises depositing a different type of material onto said surface or area.

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9. A method according to claim 8, which comprises depositing the different material by electrohydrodynamically processing a different liquid to form material comprising at least one of a fibre, fibre fragments and particles.

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10. A method according to any one of claims 2 to 9, which comprises effecting relative movement between the at least one jet and the surface or area during deposition.

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15. A method according to any one of the preceding claims, which further comprises subjecting a further liquid to the electric field, the two liquids being such that after formation the at least one jet forms a fibre which has a core formed substantially by one of the two liquids and a coating formed substantially by the other of the two liquids or breaks up into fibre fragments or particles which have a core formed substantially by one of the liquids and a coating formed substantially by the other of the two liquids.

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25. A method of forming composite matter, which comprises supplying a liquid to a first outlet and supplying a further liquid to a second outlet located adjacent the first outlet and subjecting the liquids to an electric field so as to form at least one jet, the liquids being such that, after formation, the jet forms a fibre which has a core formed substantially by one of the two liquids and a coating formed substantially by the other of the two liquids or breaks up into fibre fragments or particles which have a core formed substantially by one of the liquids and a coating formed substantially by the other of the two liquids.

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35. A method for producing material for supply to the respiratory system of an animal, which method comprises

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supplying liquid to a comminution site; generating an electric field at the comminution site to cause the liquid to form at least one jet of liquid, the liquid being such that after formation the at least one jet breaks up into electrically charged comminuted matter comprising fibre fragments or electrically charged at least partially solid particles; and at least partially electrically discharging the comminuted matter prior to supply to the respiratory system of the animal.

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14. A method according to claim 13, which further comprises subjecting a further liquid to the electric field at the comminution site, the two liquids being such that after formation the at least one jet breaks up into fibre fragments or particles which have a core formed substantially by one of the liquids and a coating formed substantially by the other of the two liquids.

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15. A method according to any one of the preceding claims, wherein the or at least one of the liquids comprises a biologically active ingredient.

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16. A method according to any one of claims 1 to 12, wherein the liquid or at least one of the liquids comprises one or more biologically active ingredients selected from the group consisting of a proteolytic enzyme, a cytokine, a growth factor such as one of fibroblast growth factor, epithelial growth factor and transforming growth factor, collagen, fibrinogen, an antibiotic, an antiseptic, an antifungal, an analgesic, an antiparasitic, a bactericide, DNA or other genetic matter, cells, a peptide or polypeptide, insulin, an adjuvant, an immune suppressant or stimulant, a surface binding or surface recognising agent such as surface protein A, a surfactant, and a vaccine.

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17. A method according to claim 13 or 14, wherein the

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or at least one of the liquids comprises one or more biologically active ingredients selected from the group consisting of DNA, a peptide or polypeptide, insulin, and growth factor.

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18. A method according to any one of the preceding claims, wherein the or one of the liquids comprises a polymer or resin.

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19. A method according to any one of the preceding claims, wherein the or one of the liquids comprises a bioresorbable or biodegradable material.

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20. A method according to any one of the preceding claims, wherein the or one of the liquids comprises animal collagen or fibrinogen.

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21. A method according to any one of claims 1 to 17, wherein the or at least one of the liquids comprises polyvinyl alcohol, polyhydroxybutyric acid, polyglycolic acid, polylactic acid, nitrocellulose or a polysaccharide.

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22. A method according to any one of the preceding claims, which comprises coating a fibre, fibril or particle with another material.

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23. A method according to claim 22, which comprises coating a fibre, fibril or particle with a biologically active material such as DNA, a surfactant, a surface recognition protein or a lipid.

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24. A method according to any one of claims 1 to 5, wherein the liquid is selected to form fibre fragments or particles comprising a biologically active material such as DNA coated or complexed with a liposome.

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25. A method of forming a composite material, which comprises supplying first and second liquids separately to a site where the liquids mix and subjecting the liquids to an electric field to form at least one liquid jet, the first and second liquids being selected to mix together so as to form a single body of material.

5 26. A method according to claim 25, wherein one of the liquid comprises thrombin and the other of the liquids 10 comprises fibrinogen which react together to form a fibrin mat.

15 27. A method according to claim 25 for forming a composite for covering a cavity wound, wherein one of the liquids comprises urethane and the other a blowing agent which react together to form a flexible polyurethane foam 20 which at least partially fills the cavity.

25 28. A method of depositing fibres on a surface, which comprises supplying liquid comprising polylactic acid having a molecular weight in the region of 144000, dissolved 10% by mass in acetone, at approximately 10 millilitres per hour to an electrohydrodynamic site located at about 5 to 10 cm above the surface.

30 29. A method of depositing fibres on a surface, which comprises supplying liquid comprising nitrocellulose at approximately four millilitres per hour to an electrohydrodynamic site located at about 5 to 10 cm above the surface.

35 30. A device for depositing material onto a surface, which comprises a supply of liquid, means for subjecting said liquid to an electric field at an outlet to cause the liquid to form at least one jet of electrically charged liquid, the liquid being such that the at least one jet forms a fibre or breaks up into fibre fragments

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or particles which are attracted to and deposit on said surface when the device is placed in the vicinity of said surface during use.

5 31. A device for producing material for supply to a cavity or to a concave surface, which comprises a supply of liquid, means for subjecting said liquid to an electric field at an outlet to cause the liquid to form at least one jet of electrically charged liquid, the liquid being such that after formation the at least one jet forms charged matter comprising a charged fibre or charged fibre fragments or charged particles, and means for at least partially electrically discharging the charged matter before it reaches the cavity or concave surface.

10 32. A device according to claim 31, further comprising means for providing an air or inert gas flow to assist supply of the material to the cavity or concave surface.

15 33. A hand holdable device for applying a dressing to an area of an animal such as an area of skin, a wound, a burn or an area exposed by a surgical procedure, which device comprises a supply of liquid, means for supplying said liquid to an outlet; and means for subjecting the liquid to an electric field at the outlet to cause the liquid to form at least one jet of electrically charged liquid, the liquid being such that after formation the at least one jet forms charged matter comprising a charged fibre or charged fibre fragments or charged particles so that when the device is positioned in use adjacent said surface so as to direct said jet towards said area said charged matter is attracted to and deposits on said area to form a dressing.

20 34. A device according to any one of claims 30 to 33, which further comprises a supply of a further liquid,

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means for supplying the further liquid to said outlet, the two liquids being such that, in use of the device, after formation the at least one jet forms a fibre which has a core formed substantially by one of the two liquids and a coating formed substantially by the other of the two liquids or breaks up into fibre fragments or particles which have a core formed substantially by one of the liquids and a coating formed substantially by the other of the two liquids.

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35. A device according to any one of claims 30 to 34, wherein the liquid or a liquid has features or characteristics as recited in any one of claims 15 to 21, dependent on the intended use of the device.

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36. A fibrin mat formed by electrohydrodynamically processing thrombin and fibrinogen.

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37. A mat or web comprising at least one of at least one fibre, fibrils, and particles formed by electrohydrodynamically processing at least one liquid.

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38. A dressing for a wound or burn comprising a mat or web in accordance with claim 37.

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39. A substrate carrying a coating comprising electrohydrodynamically formed matter comprising at least one of at least one fibre, fibre fragments or fibrils and particles.

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40. A fibre, fibre fragment or capsule having a core of an active ingredient and a protective coating of, for example, a polymer, formed by electrohydrodynamic processing of at least two liquids.

41. A method of forming at least partially solid or gel-like material, which comprises supplying a liquid to a

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single outlet, subjecting liquid issuing from the outlet to an electric field thereby causing the liquid to form at least one jet of electrically charged liquid, the liquid at least partially solidifying or gellifying after formation of the at least one jet to form a fibre or to form fibre fragments or particles.

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